c) ***Schottky enabled high brightness electron beam generation at the ANL:*** We have initiated a first ever study of Schottky-enabled photoemission using the AWA drive gun. In a conventional rf photoinjector, the incident photon energy is greater than the photocathode work function. Ordinary Schottky *assisted* photoemission takes place because the rf electric field in the gun lowers the effective work function, thus allowing the incident photons to liberate more electrons. In our scheme, Schottky *enabled* photoemission, the incident photon energy is less than the photocathode work function. In this case, no electrons are emitted from the photocathode until the effective work function is lowered to the photon energy (threshold); at this point, electrons begin to be emitted. There are two important consequences that can be drawn from this work:

(i) At threshold, electrons are emitted with very little kinetic energy. This is because the kinetic energy of the electrons is due to the energy difference between the photon energy and the work function. Consequently, these electrons have an extremely low intrinsic emittance. Since the intrinsic emittance is thought to be the limiting value of the emittance, this technique opens up the possibility of reaching even lower emittance values.

(ii) Interestingly, this technique of using a low energy photon allows for the most direct determination of the field-enhancement factor on a cathode's surface. Such ability can be easily extended to determine the field enhancement factor of various metals such as Cu and Nb, and fabrication methods for the surface finishes.

Further work in this area involves the actual measurement of the emittance of the electron beam generated in this manner, as well as the study of other photocathode materials such as diamond.